WHAT IS CLAIMED IS:

1. A clamping assembly for a bend arm of a tube bending machine, the clamping assembly comprising:

a bend arm slider having a first end and a second end, the slider first end configured to receive a clamp die, the slider coupled to a guide member configured to move along an arcuate surface of a camming member coupled to the bend arm;

a first lever having a first end and a second end, the first lever having a pivot axis and coupled to a first pivot member, the first pivot member coupled to the bend arm, and the first lever first end coupled to the slider second end and configured to drive the slider along the arcuate surface;

a toggle link having a first end and a second end, the toggle link first end coupled to the first lever second end, the toggle link configured to rotate the first lever about the first lever pivot axis;

a drive link having a first end and a second end, the drive link first end coupled to the toggle link second end, the drive link configured to drive the toggle link;

a second pivot member coupled to the drive link such that the drive link pivots about a second pivot member axis;

a bearing member coupled to the bend arm and having a bearing axis, the bearing member coupled to the second pivot member at a location offset from the bearing member axis;

an actuator coupled to the drive link second end and configured to rotate the drive link about the second pivot member axis such that a force is communicated from the actuator through the drive link, the toggle link, and the first lever to thereby cause the slider to retract or extend along the arcuate surface in response to the force;

a second lever having a first end and a second end, the second lever first end pivotally coupled to the bearing member and fixedly attached to the second pivot member; and

wherein the actuator is coupled to the second lever second end and configured to actuate the second lever so as to rotate the bearing member about the bearing axis

thereby communicating a force via the drive link, the toggle link, and the first lever to the slider, resulting in the transmission of a controlled, variable force from the actuator to the clamp die.

2. The clamping assembly of Claim 1, further comprising a rod coupling the actuator to the drive link, the rod configured to engage with and to rotate the drive link about the second pivot member, the rod further configured to engage with and drive the force multiplier arm thereby causing the force multiplier arm first end to rotate the bearing member about the bearing member axis thereby moving the drive link toward or away from the toggle link in response to the force.

3. The clamping assembly of Claim 1, wherein a guide slot of the bend arm defines the camming surface.

4. The clamping assembly of Claim 1, further comprising a bearing block configured to receive and support the bearing member.

5. The clamping assembly of Claim 1, wherein the actuator is an electric motor.

6. The clamping assembly of Claim 2, further comprising a guide slot for guiding the rod.

7. The clamping assembly of Claim 6, wherein the guide slot is part of the drive link.

8. The clamping assembly of Claim 1, wherein the coupling of the actuator to the drive link and to the second lever comprises a lead screw mechanism.

9. A clamping assembly for a tube bending machine, the clamping assembly comprising:

a bend arm slider configured to receive a clamp die;

a linkage assembly including at least one linkage member, the linkage assembly configured to move the bend arm slider;

a pivot member coupled to the linkage member such that a portion of the linkage member pivots about an axis of the pivot member;

a bearing member having an axis, the bearing member coupled to the pivot member at a location offset from the bearing member axis; and

a lever attached to the bearing member and configured to rotate the bearing member about the bearing member axis.

10. The clamping assembly of Claim 9, further comprising an actuator coupled to the linkage member so as to cause the linkage member to rotate about the pivot member axis.

11. The clamping assembly of Claim 10, wherein the actuator is further coupled to the lever so as to cause the lever to rotate the bearing member about the bearing member axis.

12. The clamping assembly of Claim 11, further comprising a lead screw mechanism for coupling the actuator to the linkage member and to the lever.

13. The clamping assembly of Claim 12, wherein the actuator is coupled to the linkage member and to the lever such that the lead screw mechanism causes the rotations of the linkage member and the bearing member during of one continuous movement of the lead screw.

14. The clamping assembly of Claim 13, wherein the coupling of the actuator to the linkage member and to the lever is such that the rotations of the linkage member and the bearing member are substantially sequential in time.

15. The clamping assembly of Claim 13, wherein the actuator, lead screw, and linkage assembly are configured such that rotation of the lead screw in a first direction results in a raising and extending of the slider.

16. The clamping assembly of Claim 14, wherein the actuator, lead screw, and linkage assembly are configured such that rotation of the lead screw in a second direction results in a lowering and retracting of the slider.

17. The clamping assembly of Claim 15, wherein the actuator, lead screw, lever, and pivot member are configured such that a rotation of the lead screw in a first direction results in the rotation of the linkage member about the bearing member axis.

18. The clamping assembly of Claim 9, wherein the linkage assembly, comprises a toggle link coupled to the linkage member.

19. The clamping assembly of Claim 18, further comprising a stop member configured to provide a stop at a coupling of the toggle link and the linkage member.

20. The clamping assembly of Claim 12, wherein the actuator is programmed to a exert a torque up to a preset limit on the lead screw mechanism such that lever is subject to a substantially constant force during clamping of a workpiece by the clamping assembly.

21. The clamping assembly of Claim 10, wherein the linkage assembly comprises a lever having two arms, wherein a first arm of the lever is coupled to the toggle link and a second arm of the lever is coupled to the slider.

22. A leverage mechanism for use with a clamp die positioning linkage assembly, the leverage mechanism comprising:

a bearing member having a bearing member axis;

a pivot member having a pivot member axis, the pivot member fixedly attached to the bearing member such that the bearing member axis and the pivot member axis are substantially parallel and offset relative to one another;

a bearing block for receiving and supporting the bearing member, the bearing block configured for attachment to a bend arm of a tube bending machine; and

a lever arm coupled to the bearing member for causing the bearing member to pivot about the bearing member axis.

23. The leverage mechanism of Claim 22, further comprising a drive link coupled to the pivot member and configured to pivot about the pivot member axis.

24. The leverage mechanism of Claim 23, further comprising a toggle link pivotally coupled to the drive link.

25. The leverage mechanism of Claim 22, further comprising a connecting member that fixedly attaches the bearing member to the pivot member.

26. The leverage mechanism of Claim 25, wherein the lever arm couples to the connecting member.

27. The leverage mechanism of Claim 22, wherein the bearing member comprises a cylindrical body.

28. The leverage mechanism of Claim 22, wherein the pivot member comprises a cylindrical body.

29. The leverage mechanism of Claim 27, wherein the bearing block comprises a cylindrical bore for receiving and supporting the bearing member.

30. The leverage mechanism of Claim 26, wherein the lever arm is configured for coupling to an actuator.

31. A method of manufacturing an assembly for leveraging the force of an actuator to provide a clamping force at a clamp die of a tube bending machine, the method comprising:

providing a bearing member having a bearing member axis;

providing a bearing block for receiving and supporting the bearing member, the bearing block configured for attachment to a bend arm of a tube bending machine;

fixedly attaching a pivot member having a pivot member axis to the bearing member such that the bearing member axis and the pivot member axis are substantially parallel and offset relative to one another;

coupling a drive link to the pivot member;

coupling the drive link to a linkage assembly such that the linkage assembly transmits a force from the drive link to the clamp die;

coupling a lever arm to the bearing member for causing the bearing member to pivot about the bearing member axis; and

coupling an actuator to the lever arm such that a force generated by the actuator is applied to the lever arm so as to cause the lever arm to rotate the bearing member about the bearing member axis and thereby to cause the drive link to rotate about the bearing member axis.

32. The method of Claim 31, wherein the drive link is pivotally coupled to the pivot member.

33. The method of Claim 31, wherein providing a linkage assembly comprises providing a toggle link that couples to the drive link.

34. The method of Claim 31, wherein a distance D2 between the bearing member axis and a line of action of the force generated by the actuator is greater than an offset distance D1 between the bearing member axis and the pivot member axis.

35. A clamping assembly for a bend arm of a tube bending machine, the clamping assembly comprising:

a bend arm slider configured to receive a clamp die and to move along a camming member;

a first class lever having first and second arms, the first arm of the first class lever coupled to the slider;

a toggle link coupled to the second arm of the first class lever and configured to actuate the first class lever;

a drive link configured to drive the toggle link;

a pivot member coupled to the drive link such that a portion of the drive link pivots about an axis of the pivot member;

a bearing member having a bearing member axis, the bearing member coupled to the pivot member at a location offset from the bearing member axis;

an actuator configured to rotate the drive link about the pivot member axis such that a force is communicated from the actuator through the drive link, connecting link, and first-class lever to thereby actuate the slider;

a lever arm coupled to the bearing member at the offset location such that the lever arm and the bearing member cooperate to form a second class lever; and

wherein the actuator is configured to actuate the lever arm so as to rotate the bearing member about the bearing member axis resulting in the transmission of a force, via the drive link and the toggle link, from the actuator to the first class lever.

36. The clamping assembly of Claim 35, wherein the first and second arms of the first class lever are of equal length.

37. The clamping assembly of Claim 35, wherein the drive link comprises a first class lever.

38. The clamping assembly of Claim 35, wherein the pivot member is fixedly attached to the bearing member.

39. The clamping assembly of Claim 35, further comprising a bearing block having a space for receiving and supporting the bearing member.

40. The clamping assembly of Claim 39, wherein the bearing member comprises a cylindrical body and the space for receiving and supporting comprises a cylindrical bore, and wherein the cylindrical body is configured to rotate within the cylindrical bore.

41. The clamping assembly of Claim 35, further comprising a coupling between the actuator and the drive link, wherein said coupling comprises a lead screw mechanism.

42. The clamping assembly of Claim 41, further comprising a coupling between the actuator and the lever arm, wherein said coupling comprises the lead screw mechanism.

43. A clamping assembly for a tube bending machine, the clamping assembly comprising:

linkage means for raising and extending or lowering and retracting a clamp die relative to a bend die of the tube bending machine;

a bearing member having a bearing member axis, the bearing member coupled to pivot means at a location offset from the bearing member axis;

lever means coupled to the bearing member at the offset location; and

actuating means configured to actuate the lever arm so as to rotate the bearing member about the bearing member axis resulting in the transmission of a force via the linkage means from the actuating means to the clamp die.

44. The clamping assembly of Claim 43, wherein the linkage means comprises a toggle link.

45. The clamping assembly of Claim 43, wherein the bearing means comprises a cylindrical body and a bearing block, wherein the cylindrical body is configured to rotate inside a bore of the bearing block, and wherein the bearing block is configured for attachment to a bend arm of the tube bending machine.

46. The clamping assembly of Claim 43, wherein the actuating means comprises an electrical motor.

47. The clamping assembly of Claim 46, wherein the actuating means further comprises a lead screw mechanism.

48. The clamping assembly of Claim 45, wherein at least part of the linkage means is pivotally coupled to the pivot means.

49. A bend head for a tube bending machine, the bend head comprising:

a bend arm configured to cooperate with a rotary bend die for bending a workpiece;

a linkage assembly coupled to the bend arm for positioning a clamp die, the clamp die configured to grip the workpiece in cooperation with the bend die;

a bearing member having a bearing member axis;

a bearing block configured to support the bearing member and to be coupled to the bend arm, wherein the bearing member is configured to rotate about the bearing member axis inside a bore of the bearing block;

a pivot member attached to the bearing member at a location offset from the bearing member axis; and

a lever configured to rotate the bearing member about the bearing member axis, a first end of the lever attachable to the bearing member.

50. The bend head of Claim 49, wherein the linkage assembly comprises a toggle link.

51. The bend head of Claim 49, wherein the bearing member comprises a solid cylindrical body having a surface in contact with the bore of the bearing block.

52. The bend head of Claim 49, wherein the bearing member axis and a line of action of a force applied by the actuator at the lever second end define a distance D2.

53. The bend head of Claim 52, wherein the bearing member axis and the location offset from the bearing member axis define a distance D2.

54. The bend head of Claim 53, wherein D1 is greater than D2 such that the force is magnified by a ratio substantially equal to D1:D2.

55. The bend head of Claim 49, further comprising an actuator coupled to a second end of the lever to cause the lever to rotate the bearing member.

56. The bend head of Claim 55, wherein the actuator is an electric motor.

57. A method of positioning a clamp die and gripping a workpiece with the clamp die, the method comprising:

raising and extending a bend arm slider to position the clamp die at a location opposite to a rotary bend die, wherein the raising and extending is accomplished in part by a linkage assembly comprising at least one linkage member; and

applying a first force to the linkage member via a lever mechanism such that a second force applied to the lever mechanism is less than the second force.

58. The method of Claim 57, wherein the linkage assembly comprises a toggle link.

59. The method of Claim 57, wherein an actuator coupled to the lever mechanism applies the second force.

60. The method of Claim 59, wherein applying a first force comprises pivoting the linkage member about a first fixed axis.

61. The method of Claim 60, wherein the lever mechanism comprises a bearing member coupled to a lever arm.

62. The method of Claim 61, wherein the lever mechanism further comprises a pivot member fixedly attached to the bearing member.

63. The method of Claim 62, wherein the bearing member comprises a cylindrical body configured to rotate in a cylindrical bore of a bearing block.

64. The method of Claim 63, wherein the magnitude of the first force is at least two times the magnitude of the second force.

65. The method of Claim 63, wherein the magnitude of the first force is at least five times the magnitude of the second force.

66. The method of Claim 65, wherein the magnitude of the first force is at least ten times the magnitude of the second force.

67. The method of Claim 63, wherein the acts of raising and extending the bend arm slider are performed simultaneously.

68. The method of Claim 67, wherein the act of applying the first force is performed subsequent to the acts of raising and extending.

69. The method of Claim 68, further comprising the acts of lowering and retracting the bend arm slider relative to the bend die.

70. The method of Claim 69, wherein the acts of lowering and retracting the bend arm slider are performed simultaneously.

71. A mechanism for positioning a clamp die and gripping a workpiece with the clamp die, the mechanism comprising:

means for raising and extending a bend arm slider to position the clamp die at a location opposite to a rotary bend die, wherein the raising and extending is

accomplished in part by a linkage assembly comprising at least one linkage member; and

means for applying a first force to the linkage member via a lever mechanism such that a second force applied to the lever mechanism is less than the second force.

72. The mechanism of Claim 71, wherein the means for raising and extending comprises an electric motor coupled to the linkage member.

73. The mechanism of Claim 72, wherein the means for raising and extending comprises a lead screw mechanism coupled to the electric motor.

74. The mechanism of Claim 73, wherein the means for applying a first force comprises a bearing member supported by a bearing block, and wherein the linkage member is fixedly attached to the bearing member.

75. The mechanism of Claim 74, wherein the point of attachment of the linkage member to the bearing member is offset from an axis of rotation of the bearing member by a distance L1.

76. The mechanism of Claim 75, wherein the lever mechanism comprises a lever arm, the lever arm coupled to the bearing member.

77. The mechanism of Claim 76, wherein the line of action of the lead screw and the axis of rotation of the bearing member define a distance L2 such that L2 is greater than L1.

78. The mechanism of Claim 77, wherein L2 is at least two times greater than L1.

79. The mechanism of Claim 78, wherein L2 is at least five times greater than L1.

80. The mechanism of Claim 79, wherein L2 is greater than nine times L1.